ELECTRICAL PROPERTIES OF TITANIUM NITRIDE FILMS SYNTHESIZED BY REACTIVE MAGNETRON SPUTTERING

Mohammed W.M., Gumarov A.I., Vakhitov I.R, Yanilkin I.V.,

Nikitin S.I., Tagirov L.R., Yusupov R.V.

Kazan Federal University, Kremlevskaya str. 16a, 420008 Kazan, Russia

e-mail: waelmohammed88@yahoo.com

A use of the four-probe resistance measurements as a tool for characterization of a quality of titanium nitride thin films deposited by the reactive dc magnetron sputtering will be discussed in the report. Few series of ~ 50 nm thick films on various substrates as fused silica, monocrystalline silicon and magnesium oxide have been deposited with several degrees of freedom (substrate temperature, magnetron chamber atmosphere and working pressure etc.) varied in a wide range. Electrical resistivity correlation with the films properties will be reported.

Titanium nitride (TiN) is a material that for a long time is used in many technological, medical and scientific fields due to its outstanding properties. Recently, it has been found that TiN thin films may serve also as the plasmonic materials that can hold the temperatures much higher than the classic plasmonic elementary compounds like gold, silver or copper [1].

Titanium nitride (TiN) films were deposited by the reactive dc magnetron sputtering with the power of 150 W on the cleaned silicon, fused silica and crystalline magnesium oxide substrates at room temperature. Titanium metal target with a purity of 99.99% was used for deposition. Before the deposition the pressure was set to $5 \cdot 10^{-3}$ mbar inside the chamber with argon and nitrogen gas partial pressures of Ar: N_2 = 0:10, 2:8, 4:6, 6:4 and 8:2. The film compositions were tested with X-ray photoemission spectroscopy both before the samples were taken out of the deposition setup and after leaving them for some time in the air.

The resistivity measurements were performed using the van der Pauw four-point probe system. One of the problems that had to be solved was a development of the way to create the resistive connection which was not the case for, e.g., aluminium or gold wire ultrasound bonding. We have found that the best choice is the indium/gallium alloy.

Results of the correlation study between the structure, composition, deposition conditions with the resistivity value of the films will be reported and discussed.

REFERENCES

1. G.V. Naik et al. *Optical Materials Express* **2** (2012) 478.